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#### LAW OFFICES

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### FAX MESSAGE

Number of Pages: 22

(Please let us know by phone or fax if you do not receive any of these pages)

**Date:** July 9, 2007

\* \* \* \* \* \* \* \* \*

To:

Ben Lewis, Examiner

Company: U.S. Patent & Trademark Office

Fax Number: ...(571) 273-8300

**Phone Number:** ...(571) 272-6481

From: John A. Miller/Catherine Carlson

\* \* \* \* \* \* \* \* \* \*

Re: Attorney Docket No. GP-302076/Our File No. GMC-00037 Exhibits A, B and C to the Declaration under 37 CFR 1.131 follow. These Exhibits were inadvertently omitted from the EFS WEB filing of the Response to Non-Final Office Action on June 14, 2007.

Please acknowledge receipt. Thank you.

#### **NOTICE:**

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#### PATENT

#### IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Application No.:

10/811,204

RECEIVED CENTRAL FAX CENTER

March 26, 2004

JUL 0 9 2007

Applicant:

Filing Date:

Daryl Chapman et al.

**Group Art Unit:** 

1745

Examiner:

Ben Lewis

Title:

NON-FLAMMABLE EXHAUST ENABLER FOR

HYDROGEN POWERED FUEL CELLS

Attorney Docket:

GP-302076

Mail Stop Amendment Commissioner for Patents P.O. Box 1450 Alexandria, VA 22313-1450

#### **DECLARATION UNDER 37 CFR 1.131**

We, Daryl Chapman, Prem. C. Menon, David Masten and Norman Dill, do hereby declare that:

- 1. We are the inventors of United States Patent Application Serial No. 10/811,204, titled "Non-Flammable Exhaust Enabler for Hydrogen Powered Fuel Cells," filed March 26, 2004.
- 2. We conceived of and worked on the invention claimed in the '204 application while we were employees of the General Motors Corporation as engineers.

- 3. Prior to July 16, 2003, we conceived of the invention claimed in the '204 application and prepared the Invention Disclosures shown in exhibit A that describe the claimed invention.
- 4. Prior to July 16, 2003, we submitted the invention disclosures shown in exhibit A to the Patent Review Board at General Motors Corporation, where they were approved for filing as a patent application.
- 5. Prior to July 16, 2003, we were contacted by a patent attorney who prepared the '204 patent application as supported by the correspondences in exhibit B.
- 6. Prior to July 16, 2003, we received a first draft of the '204 application for our review.
- 7. Sometime during the remainder of 2003, we reviewed the first draft of the '204 application, passing it between the several inventors, and we also added additional embodiments to the application as shown by the correspondences in exhibit C.
- 8. A first final draft of the '204 application was finished by the patent attorney sometime in late January of 2004.

- 9. Sometime in February of 2004 we were presented with the first final draft of the application and the formal papers to be signed, at which time we provided further review of the '204 application as shown by the correspondence of exhibit D.
- 10. A second final application was then provided by the patent attorney sometime in February of 2004, which was the filed version of the application.
- 11. I hereby declare that all statements made herein are my own knowledge and are true, and that all statements made upon information and belief are believed to be true; and further that these statement were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, under §1001 of Title 18 of the United States Code, and that such willful statements may jeopardize the validity of the application or any patent that may issue thereon.

Daryl Chapman

Prem. C. Menon

Date

David Masten

Date

Manaa Vill

Norman Dill

Date

# **EXHIBIT A**

Inter Organization

## General Motors

Global Alternative Propulsion Center

Date:

January 14, 2002

To:

K. F. Barr

From:

J. L. Saller

Subject:

GP-302 076: Non Flammable Exhaust Enabler for Hydrogen

**Powered Fuel Cells** 

Inventor(s): D. Chapman, P. Menon, N. Dill, D. Masten

Please review the enclosed inventive concept submission, GP-302 076: Non Flammable Exhaust Enabler for Hydrogen Powered Fuel Cells.

This concept is not associated with a Government Contract.

Thank you,

James S. Saller

RECEIVED
GENERAL MOTORS CORPORATION

JAN 1 5 2002

**LEGAL STAFF** 

General Motors Corporation Global Alternative Propulsion Center SUBLETTE DOC

285 Metro Park Mail Code 146-HEN-580

Rochester, NY 14623

Fax 716-239-7310 (8-225)

100

CONFIDENTIAL AND PRIVILEGED



File No.

GP 302 076

## **RECORD OF INVENTION**

This Record of Invention must be completed with sufficient detail so that your invention can be understood and evaluated by both your engineering management and by a GM Legal Staff patent attorney. Novelty and competitive significance of your invention will be evaluated based on the information you provide.

Invention Title: NON FLAMMABLE EXHAUST ENABLER FOR HYDROGEN POWERED FUEL CELLS

| Inventor #1          |                     |                      |                                       | i i                  |                   |                       |
|----------------------|---------------------|----------------------|---------------------------------------|----------------------|-------------------|-----------------------|
| Name: Daryl          |                     |                      | Chapman                               |                      | Citizen of:       | USA                   |
|                      | First Name          | Middle Initial       | Last Nam                              | ie .                 | <del></del>       |                       |
| Social Security No   | ).                  |                      | GM Employee:                          | ⊠ Yes ☐ No           | Salary 🗌 Hou      | rly Contract          |
| Home Address:        | 22 Ketchum Stree    | t                    | Victor                                | , NY                 |                   | 14564                 |
|                      |                     | Street               |                                       | City and             | State             | Ses Zip Code          |
| GM Unit: Glob        | al Alternative Prop | ulsion Center        |                                       | GM Phone No.         | (8)-225-6770      | 716-624-6770          |
|                      | <u>-</u>            |                      |                                       |                      | Centrex Number    | (Area Code) + Number  |
| GM Address:          | 10 Carriage St., Ho | neoye Falls, NY      | 14470 Mail Code                       | : 144-001-101        | FAX Number:       | (8)-225-6880          |
|                      |                     |                      | •                                     |                      |                   | Centrex Number        |
| Non-GM Employe       | r:                  |                      |                                       |                      | Phone No.         |                       |
|                      |                     |                      |                                       | •                    |                   | (Area Code) + Number  |
| Non-GM Employe       | er Address:         |                      |                                       |                      |                   |                       |
|                      |                     | Str                  | ect                                   | City and State       |                   | Zip Code              |
|                      |                     |                      |                                       |                      |                   |                       |
| Inventor #2*         | •                   | _                    |                                       |                      |                   |                       |
| Name: Prem.          |                     | <u>C</u>             | Menon                                 |                      | Citizen of: India |                       |
|                      | First Name          | Middle Initial       | Last Nam                              |                      | 576. D.           |                       |
| Social Security No   | )                   |                      | GM Employee:                          | Yes No               | Salary Ho         | urly Contract         |
| Home Address:        | 165 W Squire Dr.    | Ant #5               | Roche                                 | ster, NY             |                   | 14623                 |
| rome recercis.       | 105 W Squite Di     | Street               |                                       | City and             | State             | Zip Code              |
| GM Unit: Glob        | al Alternative Prop | ulsion Center        |                                       | GM Phone No.         | (8)-225-6777      | 716-624-6777          |
| <u> </u>             |                     |                      | · · · · · · · · · · · · · · · · · · · |                      | Centrex Number    | (Area Code) + Number  |
| GM Address:          | 10 Carriage Street, | Honeove Falls        | Mail Code                             | : 144-001-101        | FAX Number:       | (8)-225-6880          |
|                      | g,                  |                      |                                       | <del></del>          |                   | enter Number          |
| Non-GM Employe       | ar-                 |                      |                                       |                      | KELLE             | ころとり                  |
| rvoir-civi Employ    |                     |                      |                                       |                      | GENERAL MOTO      | RS CORPORATION Number |
| Non-GM Employe       | er Address:         |                      |                                       |                      | <u></u>           | •                     |
| radii-Olar Ellipioyi |                     | Str                  | cci                                   | Cit                  | y and State JAN   | 5 2002 Zip Code       |
|                      |                     | _                    |                                       | :                    | ,                 |                       |
| * If there are       | more than two (2) i | nventors for this is | ention use the temp                   | late at the end of t |                   |                       |
|                      |                     |                      |                                       |                      | I FGAL            | STAFF                 |
|                      |                     |                      |                                       |                      |                   |                       |
| Rev. 5/00            |                     | Fi                   | le Number:                            | •                    |                   | 1 of                  |

#### Inventor # 3

| Name:     | David          |                          | Α.             | Masten          |                | Citizen of: USA . |                      |
|-----------|----------------|--------------------------|----------------|-----------------|----------------|-------------------|----------------------|
|           |                | First Name               | Middle Initial | Last Name       | <b>e</b>       | <del></del>       |                      |
| Social Se | ecurity No     | ·                        |                | GM Employee:    | Yes □ No       | Salary Hourly     | Contract             |
| Home A    | ddress:        | 30 Knollbrook Rd, Ap     | artment 6      | Roche           | ster, NY       | ·                 | 14610                |
|           |                | \$                       | itreet         |                 | City and State |                   | Zip Code             |
| GM Unit   | t: Globa       | al Alternative Propulsio | n Center       |                 | GM Phone No.   | (8)-225-6606      | 716-624-6606         |
|           | •              |                          |                | •               |                | Centrex Number    | (Area Code) + Number |
| GM Add    | lress:         | 10 Carriage St., Honeo   | ye Falls, NY 1 | 4623 Mail Code: | 144-001-101    | FAX Number:       | (8)-225-6880         |
|           |                | •                        |                | •               |                |                   | Centrex Number       |
| Non-GM    | Employe        | г:                       |                |                 |                | Phone No.         |                      |
|           |                |                          |                |                 |                |                   | (Area Code) + Number |
| Non-GM    | Employe        | r Address:               |                | •.              |                |                   | ·                    |
|           |                |                          | Stre           | et              | City           | and State         | Zip Code             |
|           |                | •                        | _              | •               |                |                   |                      |
|           |                |                          | •              |                 |                | •                 |                      |
|           |                |                          |                | ,               |                |                   |                      |
|           |                |                          |                |                 | •              |                   |                      |
| Inve      | entor # 4      |                          |                |                 |                |                   |                      |
| Name:     | Norman         |                          | 1              | Dill            | •              | Citizen of: USA   |                      |
| Name.     | Notinan        | First Name               | Middle Initial | Last Nam        |                | <u> </u>          |                      |
| 00        |                |                          | (MOOIC BIRTOT  |                 | Yes □ No       | Salary Hourly     | . Contract           |
| Social Se | ecurity No     | ·                        |                | GM Employee:    | Mies III       | ⊠ Salary ☐ Hours  | Contract             |
| Home A    | ddress:        | 3590 Baker Road          |                | Walwe           | orth, NY       | •                 | 14568                |
|           |                |                          | Street         |                 | City and       | State             | Zip Code             |
| GM Unit   | t: Glob        | al Alternative Propulsio | n Center       |                 | GM Phone No.   | (8)-225-6693      | 716-624-6693         |
|           |                |                          | •              |                 |                | Centrex Number    | (Area Code) + Number |
| GM Add    | lress:         | 10 Carriage St., Honeo   | ye Falls, NY   | Mail Code       | 144-001-101    | FAX Number:       | (8)-225-6880         |
|           |                |                          | ,              | -               |                |                   | Centrex Number       |
| Non-GM    | I Employe      | r:                       |                | -               |                | Phone No.         |                      |
|           |                |                          |                |                 |                | <del></del>       | (Area Code) + Number |
| Non-GM    | I Employe      | r Address:               |                |                 |                | •                 | ,                    |
|           | p <b>, .</b> . |                          | Stre           | ect             | Cit            | y and State       | Zip Code             |
|           |                |                          |                |                 |                |                   |                      |

File Number: 6 of 7

1. This invention was first thought of on:

### Answer questions 1 - 8, completing all of them to the best of your knowledge.

06/07/01

| 2. | This invention has been or is expected to be disclosed outside GM on:  | N/A   |
|----|--|---|
| 3. | This invention has been used or is committed to be used in production on:  | Trinity II  |
| 4. | This invention has been offered for sale outside GM on:  N/A   |   |
| 5. | Was this invention made while working on a Government Contract?  | ☐ Yes ⊠ No  |
|    | If yes, identify the government Contract No. N/A   | ·   |
| 6. | Identify the product or process in which the invention is incorporated:  | Trinity II Fuel Cell Power Module   |
| 7. | List all individuals who can provide information about the making of the in-<br>made the first sketch, description, or tests and individuals who are familia<br>invention.   | vention. This list may include individuals who ir with the facts relating to the making of the  |
|    | Daryl Chapman<br>Norm Dill<br>David Masten<br>Prem. Menon  |   |
| 8. | Each inventor has a legal duty to disclose all information known that is m information includes the relevant prior art, which may be in the form of comaterials, patents, publications, advertisements, displays, and unpublished deveyou, others in GM, competitors, suppliers, customers or others. Such informoutside GM, sales and offers of products using this invention, use of this is should be considered as an inventor of this invention. To comply with the dispution information, to the extent known. | current or past products, equipment, processes,<br>elopments and proposals—whether originated by<br>nation also includes disclosure of this invention<br>invention in production and disputes about who |
|    |  |   |
|    |  |   |
|    |  |   |
|    |  |   |
|    |  |   |
|    |  |   |
| Da | File Number  | 2 of 7  |

#### Answer question 9 thoroughly.

Describe the invention in sufficient detail so that its nature, operation and usefulness can be understood.
 (Attach drawings, diagrams and further description, when necessary. Additional guidelines are listed below.)

Currently, lower anode stoichiometric operation is necessary for increased efficiency in fuel cell systems. This makes dead-ended anode operation desirable. However, dead-ended operation does require a periodic anode purge to minimize Nitrogen / water buildup. This purged hydrogen is usually vented to the atmosphere or sent through a combustor. When vented to the atmosphere, an increased localized Hydrogen content develops which could become a combustible mixture.

The current invention allows the unsteady high hydrogen flow content to be captured in an intermediate vessel called an accumulator (3) when the stack purge valve (2) is opened. The contents of the accumulator (3) is then slowly discharged to the atmosphere or stack exhaust by a controlled release through a bleed valve (4). The appropriate bleed valve (4) size ensures the emptying of accumulator (3) contents before the next purge while keeping the released hydrogen concentration below combustible limits in an air-hydrogen mixture. The valve (4) is sized based on its operating pressure & temperature, delta P, and the required purge frequency of the fuel cell stack (1). Alternatively, a fixed orifice may be used in place of valve (4).

This allows the purged hydrogen to be released with the oxygen depleted stack exhaust air (5) at non-flammable levels and eliminates exhaust emissions and the complexities associated with a combustor and also creates a constant flow for a secondary stack operation if desired.

Mechanical and Electrical Devices: Include illustrations assigning reference numbers to the main elements and refer to the reference numbers in a description that explains how the main elements are connected or related and how they operate.

Electrical Circuits and Controls: Include circuit diagrams and a functional description.

Computer Software and Manufacturing or Business Processes: Include a flowchart or other step-by step overview.

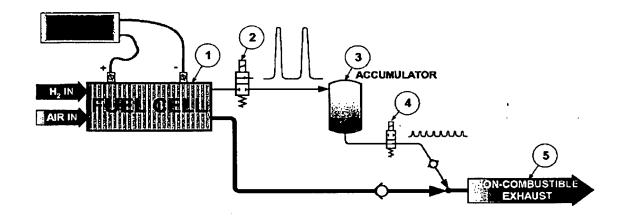
<u>Chemical Inventions:</u> Identify all essential materials used, and alternatives therefor, in chemical terms – not trade names. Identify and quantify all significant variables (e.g. temperature, pressure, concentration, pH etc.) of the process or material specifying operating ranges and the preferred example. Discuss the significance of each variable. Provide a recipe for at least one working example of the invention.

| Rev. 5/00  | File Number: | 3 of 7 |
|------------|--------------|--------|
| ********** |              |        |

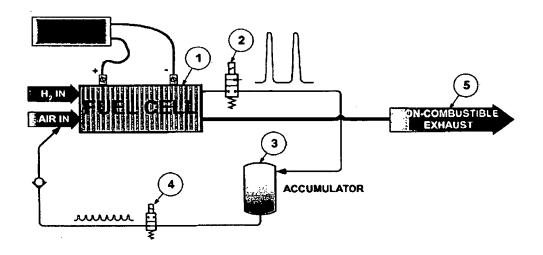
#### Answer the following questions if helpful in describing this Invention

| 10.  | What benefits will be realized by using this invention?  |
|------|--|
|      | Elimination of combustor and associated exhaust emissions in hydrogen based fuel cell systems.   |
|      |  |
|      |  |
|      |  |
| 11.  | What is the state of development of this invention?  |
|      | Dynamic modeling has been used to investigate the viability of the concept. The model has been subsequently validated by an offline experiment. The concept is being included in the Trinity II (75 KW Hydrogen Module) Project. |
|      |  |
|      |  |
| 12.  | To the extent known, what alternatives exist for accomplishing substantially the same result as this invention?  |
|      | A - Passing the hydrogen exhaust through a combustor.  |
|      | B - Hydrogen exhaust released into the atmosphere at possible combustible levels.  |
|      |  |
|      |  |
|      |  |
| 13.  | Describe the background of the invention. This description may include the state of the prior art and may identify deficiencies in the prior art that are overcome by this invention.  |
|      | Need for a clean methodology to deal with unsteady state hydrogen release.   |
|      |  |
|      |  |
|      |  |
|      |  |
|      |  |
| Rev. | 5/00 File Number: 5 of 7   |

# ACCUMULATOR CONTENTS RELEASED INTO THE NON-COMBUSTIBLE EXHAUST



# ACCUMULATOR CONTENTS RELEASED INTO THE CATHODE AIR INLET



Rev. 5/00

File Number:

GP-302-076

7 of 7

# **EXHIBIT B**

John A. Miller

From:

i.chapman@gm.com

Sent:

Monday, January 27, 2003 12:33 PM

To: Cc: miller@wbhiplaw.com prem.menon@gm.com

Subject:

Re: Patent application

John,

There were a couple of other items that were originally to be included in this application that are currently not there. Not your fault - we did not provide you the info. So we are trying to close the loop here and decide what our course of action should be. The decision should happen this week.

Daryl

"John A. Miller" <miller@wbhiplaw.com> on 01/27/2003 12:13:11 PM

Please respond to <miller@wbhiplaw.com>

To:

<i.chapman@gm.com>

cc:

Subject: Patent application

Hi Daryl. Just following up to make sure that you received the patent application for GP-302076 I emailed to you recently, and if so, when you will have an opportunity to review it. Thanks.

This message is confidential and intended only for the individual to whom

entity to which it is addressed. This message may contain information that is protected by the attorney/client privilege. If you are not the intended recipient or addressee, or an employee or agent responsible for delivering this message to the addressee, you are hereby notified that any dissemination, distribution, or copying, in whole or in part, of this message is strictly prohibited. If you believe that you have been sent this

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that you have received this email in error. Then permanently delete all copies of the message. Thank you.

John A. Miller Warn, Burgess & Hoffmann, P.C. 691 N. Squirrel Road Suite 140 Auburn Hills, Mi. 48326 miller@wbhiplaw.com (248) 364-4300 fax (248) 364-4285

...

John A. Miller

To: Subject: i.chapman@gm.com; prem.menon@gm.com

Patent application for GP-302076

Hello Daryl and Prem. Enclosed herewith is a first draft of a patent application and associated drawings for GP-302076, titled NON-FLAMABLE EXHAUST ENABLER FOR HYDROGEN POWERED FUEL CELLS. The application is formatted for A4 size paper and the drawings are in PDF format. Please review this application carefully to insure that it is both accurate and complete with respect to the subject matter you are trying to patent. Please make any changes you believe to be necessary, and return a marked-up copy of the application with your changes to me for editing. If you have any questions or concerns, please do not hesitate to call me at the number below. Thank you.





GP-302076 (37) app.doc drawing fronts for utility app...

-ATTENTION---

This message is confidential and intended only for the individual to whom or entity to which it is addressed. This message may contain information that is protected by the attorney/client privilege. If you are not the intended recipient or addressee, or an employee or agent responsible for delivering this message to the addressee, you are hereby notified that any dissemination, distribution, or copying, in whole or in part, of this message is strictly prohibited. If you believe that you have been sent this message in error, please do not read it. Please immediately reply to sender that you have received this email in error. Then permanently delete all copies of the message. Thank you.

John A. Miller Warn, Burgess & Hoffmann, P.C. 691 N. Squirrel Road Suite 140 Auburn Hills, Mi. 48326 miller@wbhiplaw.com (248) 364-4300 fax (248) 364-4285

# **EXHIBIT C**

#### John A. Miller

From: Sent: prem.menon@gm.com

Monday, January 26, 2004 4:33 PM

To:

miller@wbhiplaw.com

Subject: RE: GP-302076

I will give you the green light sometime Thursday. Thanks
Prem.

"John A. Miller" <miller@wbhiplaw.

COM>

To:

om>

cc:

Subject: RE: GP-302076

01/26/2004 03:05 PM Please respond to miller

Hello Prem. I have incorporated the comments below from Norm and Robert. Shall I forward the final application on to your in-house counsel for filing, or wait for additional comments? Thanks. John

----Original Message----

From: prem.menon@gm.com [mailto:prem.menon@gm.com]

Sent: Monday, January 26, 2004 1:31 PM

To: miller@wbhiplaw.com Subject: Re: GP-302076

Hi John,

Here is some collected input from Dan OConnell, Norm Dill, Robert Schaefer, & myself

### 1>Norm Dill brings up a good point.

One issue is the focus, as written, on automotive applications. This was originally written back when the primary focus was vehicle applications. These vehicle references should be dropped or add 'stationary' power module applications along with every reference to vehicles. For one example, Claim 14 could be deleted or add additional references to power modules which could be found in various applications from cell tower backups to shipboard power generation.

\*\*\*\*\*\*\*\*

2> Feedback from Robert Schaefer in Germany

The document says:

[0022] The pump 64 can pump the anode exhaust gas from the accumulator 26 to the input line 16 in a continuous manner, in a pulse-wise manner or otherwise. In one embodiment, the pressure in the accumulator 26 is reduced prior to the next time the purge valve 28 is opened. In alternate embodiments, the pumping can be provided by a fuel cell separator, heat exchanger or humidifier. Also, these components can be integrated within

FROM

02/28/2003 15:47 3

313-665-4976

T 300 23 TC

PAGE 01

\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

FACSIMILE COVER SHEET

\*\*\*\*\*\*\*\*\*\*

Date:

2/28/2003

To:

John Miller

Fax No.

248-364-4285

Number of Pages (including cover sheet): 3

Subject:

GP-302076

Message:

John - please incorporate concept 3 on the attached sheet, and GP-302721 into your draft

for GP-302076. Please send me an invoice under GP-302076 for the additional work.

FROM:

Cary W. Brooks, Esq.

General Motors Corp., Legal Staff

Intellectual Property Group 300 Renaissance Center

Detroit, Michigan

Telephone: (313) 665-4717

Dial 8 Network: 8 + 255-4717

Fax No.:

(313) 665-4976 or 4977

Dial 8 Network: 8 + 255-4976 or 4977

[THE INFORMATION CONTAINED IN THE ATTACHED FACSIMILE IS CONFIDENTIAL AND MAY ALSO BE ATTORNEY-CLIENT PRIVILEGED. THE INFORMATION IS INTENDED ONLY FOR THE USE OF THE INDIVIDUAL OR ENTITY TO WHOM IT IS ADDRESSED. IF YOU ARE NOT THE INTENDED RECIPIENT, OR THE AGENT OR EMPLOYE RESPONSIBLE TO DELIVER IT TO THE INTENDED RECIPIENT, YOU ARE HEREBY NOTIFIED THAT ANY USE, DISSEMINATION, DISTRIBUTION OR COPYING OF THIS COMMUNICATION IS STRICTLY PROHIBITED. IF YOU HAVE RECEIVED THE FACSIMILE IN ERROR, PLEASE IMMEDIATELY NOTIFY US BY TELEPHONE, AND RETURN THE ORIGINAL MESSAGE TO US AT P.O. BOX 33144, DETROIT, MICHIGAN 48232-5114 VIA THE U.S. POSTAL SERVICE. THANK YOU.]

02/28/2003 15:47 313-665<u>-4</u>97

T 300 23 TC

PAGE 02

#### Concept 1

Anode exhaust into cathode outlet/inlet → Prem. M/Norm Dill/Dave M/ I D Chapman→previously submitted file GP-302 076

#### Concept 2

Anode exhaust into Anode inlet using a pump→ Robert Schaefer→ previously submitted file GP-302-721

Concept 3-Not previously submitted (Dan O'Connell / Barbara More)

Concept 3 describes a method of achieving an effective recycle of the hydrogen exhaust into the anode inlet of the stack without using a pump. In this method the minimum pressure for stack operation is set to be slightly higher than the minimum achievable stack pressure due to design and piping. The anode exhaust is collected in the accumulator at this slightly higher pressure. The stack pressure is then lowered through a control algorithm to sufficiently below the accumulator pressure. The accumulator contents can then be routed directly into the anode inlet stream driven by the pressure difference. The key element here is the control algorithm that monitors accumulator pressure and adjusts stack pressure to below accumulator pressure to empty the accumulator contents. Additionally during transient operation the stack often exhausts at high pressure and the stack steps down the pressure of operation almost instantly due to a designed requirement for lower pressure. In this case the process would naturally lend itself to recycle the anode exhaust at high pressure (during a burp at high pressure) to the stack anode inlet at low pressure (after down transient)

FROM

02/28/2003 15:47 313-665-4976

T 300 23 TC FAX NO.

PAGE 03 P. 01

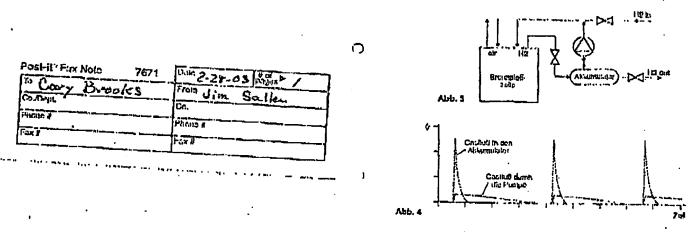
## GP-302 72/

The invention consists of a combination of the accumulator and pump - noted therefore:

1) the anode exhaust gas onters the accumulator in a pulse wise manger

2) the gas is pumped from the accumulator to the hydrogen inlet of the fuel cell. This gas can be pumped to the fuel cell either continually or in a discontinuous manner.

3) A small part of the gas can be drawn from the accumulator. This gas can be diluted with air, or combusted or otherwise converted.



In illustration 4 shows, by way of example, the temporal running of the gas flow in the accumulator and through the pump. The area under both curves be in the long term temporal on average identical, in the case no gas is removed from the circuit.

### Implementation Method:

- As for the pump, any gas compression method can be used, respectively, employment of a gas premotion means through this special arrangement. For example the use of a gas turbine or ejection method is possible. Preferably, a large pressure differential should be supplied, no matter which compression principal is utilized. (immediate volumetric function pump).
- The gas flow through the pump can be continuous, pulsating or other wise discontinuous. To decide is simply, that the pressure in the accumulator in the required manner be reduced before the next opening of the mode outlet valve occurs.
- Further subassembly can be found in the pumping between the indicated components, for example the separator, heat exchanger, humidifier. Also, these components can be integrated with the accumulator.
- The pulse wise flow of the gases out of the fuel cell can be accomplish by any valving method. The duty cycle or control method of these valves can be based on various algorithms. These algorithms can be cover by other patent submissions.
- The removal of a portion of the gases out of the circuit can also occur. Based on existing requirements (higher oxygen content) this may be a better technical and

John A. Miller

From:

i.chapman@gm.com

Sent:

Thursday, February 27, 2003 3:16 PM

To:

miller@wbhiplaw.com

Cc:

james.saller@gm.com; prem.menon@gm.com

Subject:

RE: Patent application GP-302076

John, lets proceed as you suggested. The current writeup looks good.

thanks,

Daryl

"John A. Miller" <miller@wbhiplaw.com> on 02/25/2003 11:14:09 AM

Please respond to <miller@wbhiplaw.com>

<i.chapman@gm.com>

cc:

Subject:

RE: Patent application GP-302076

Thanks Daryl. I think the thing to do is to file a patent application on the current write-up and then file other "continuation-in-part" applications

on the other embodiments when they are ready. If you agree, please let me have your changes on the current write-up or if it is good as is, please let

me know that. John.

----Original Message----

From: i.chapman@gm.com [mailto:i.chapman@gm.com]

Sent: Tuesday, February 25, 2003 6:50 AM

To: miller@wbhiplaw.com

Subject: Re: Patent application GP-302076

I will check with our patent attorney again. I am waiting on them. Your current writeup looks good for my roi. I was told they were rolling two more roi's into this one so I assumed they were in the process of doing this. If you need to notify someone of the delay please do so.

Daryl Chapman

"John A. Miller" <miller@wbhiplaw.com> on 02/24/2003 04:51:55 PM

Please respond to <miller@wbhiplaw.com>

<i.chapman@gm.com>

cc:

Patent application GP-302076 Subject:

Hi Daryl. Just checking the status of this patent application. I remember you mentioned you may add new embodiments. If the delay is going to be

| significant, | I want   | to notify | Ms patent | counsel of | that. Tha | <b>`</b> |
|--------------|----------|-----------|-----------|------------|-----------|----------|
|              | <b>-</b> |           | ATTENT    | ON         |           |          |

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